

# Proposing a New Foundation of Attack Trees in Monoidal Categories

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**Abstract.** TODO

## 1 Introduction

What do propositional logic, multisets, directed acyclic graphs, source sink graphs, Petri nets, and Markov processes all have in common? They are all mathematical models of attack trees [?], but even more than that, they can all be modeled in some form of a symmetric monoidal category<sup>1</sup> [?] – for the definition of a symmetric monoidal category see Appendix A. Taking things a little bit further, monoidal categories have a tight correspondence with linear logic through the beautiful Curry-Howard-Lambek correspondence [?]. This correspondence states that objects of a monoidal category correspond to the formulas of linear logic and the morphisms correspond to proofs of valid sequents of the logic. I propose that attack trees – in many different flavors – be modeled as objects in monoidal categories, and hence, as formulas of linear logic.

The Curry-Howard-Lambek correspondence is a three way relationship:

Categories	$\iff$	Logic	$\iff$	Functional Programming
Objects	$\iff$	Formulas	$\iff$	Types
Morphisms	$\iff$	Proofs	$\iff$	Programs

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<sup>1</sup> We provide a proof that the category of source sink graphs is monoidal in Appendix B.

- 2 Attack Trees
- 3 Concrete Semantics of Attack Trees in Dialectica Spaces
- 4 Abstract Semantics of Attack Trees in Monoidal Categories
- 5 Lina: A Domain Specific PL for Threat Analysis

## References

- A Symmetric Monoidal Categories
- B Source Sink Graphs are Symmetric Monoidal